IJN
Iranian Journal of Neonatology
http://ijn.mums.ac.ir

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Original Article

The Relationship between Neonatal Jaundice and Maternal and Neonatal Factors

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ABSTRACT

***Background*:** Maternal and neonatal factors could help determine the potential incidence of hyperbilirubinemia. In this study, we aimed to identify the relationship between the severity of jaundice in newborns and maternal and neonatal factors.

***Methods*:** This descriptive, cross-sectional study was conducted in 2014. Icteric newborns, admitted to Qods and Kowsar teaching hospitals in Qazvin, Iran were recruited in the study. Data were collected, using a researcher-made checklist consisting of three parts: demographic, maternal, and neonatal information. For data analysis, statistical tests including t-test, Mann-Whitney, analysis of variance, and Pearson's correlation test were performed, using SPSS version 19.

***Results*:** The results showed that the mean total bilirubin level was significantly higher in newborns delivered vaginally (17.3±3.5 mg/dl), compared to cases born by cesarean section (16.1±3.9 mg/dl) (P=0.02). Also, the mean total and direct bilirubin levels were higher in neonates delivered using oxytocin (0.4±.1 and 17.99±0.4, respectively), compared to those without oxytocin induction (0.383±0.1 and 16.2±0.28, respectively) (P=0.001). Moreover, the mean total and direct bilirubin levels were higher among female newborns (0.397±0.013 and 17.2±0.29, respectively), compared to the male neonates (0.379±.22 and 15.9±0.37, respectively) (P=0.005 and P=0.02, respectively).

***Conclusion*:** Since factors such as mode of delivery, oxytocin induction, and neonate's gender could contribute to jaundice, continuous assessment of newborns after birth could facilitate early diagnosis, promote disease management, and reduce the subsequent complications.

Keywords: Infants, Jaundice, Maternal factor

Introduction

Jaundice is one of the most common causes of neonatal readmission to hospitals. Although numerous attempts have been made to identify newborns at risk of severe hyperbilirubinemia, diagnosis of this condition is quite challenging (1, 2). According to statistics, jaundice occurs in 60% of term and 80% of preterm newborns in the first week of birth.

Although jaundice is a benign condition, newborns should be assessed in order to prevent further progression into severe hyperbilirubinemia and acute encephalopathy (3). In fact, condensation of bilirubin in the brain may result in temporary or permanent brain injury. Also, kernicterus is a rare but serious complication of hyperbilirubinemia. Therefore, early diagnosis of jaundice is of great significance (4, 5).

Many studies have been performed to identify factors affecting neonatal hyperbilirubinemia. Based on the findings, several risk factors have been introduced as the determinants of jaundice including maternal and neonatal risk factors such as the newborn's age, ethnicity, Rh blood group, maternal diseases, neonate's gender, birth weight, frequency of nutrition and defecation, birth trauma, and history of jaundice among siblings (6-9).

Mode of delivery also influences the severity of jaundice (10). Unnecessary interventions during delivery such as excessive use of oxytocin during labor and cesarean section are also considered as the risk factors (11-13). According to a study by Temok et al. (2004), the prevalence of jaundice was higher among neonates born by cesarean section, compared to those who were naturally delivered (11). On the contrary, Boskabadi et al. (2012) found no significant relationship between the mode of delivery and the incidence of jaundice (14). Also, Chang et al. (2011) reported that bilirubin level was higher among naturally delivered neonates, compared to those born by cesarean section (12).

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Despite the fact that the prevalence of jaundice has increased over the past years, no research has been conducted on the contributing factors. Considering the discrepancy between the findings on factors influencing neonatal jaundice (e.g., mode of delivery and anesthesia) and the constantly rising prevalence of cesarean section, the current study was designed and implemented to investigate the effects of the mentioned factors on neonatal jaundice.

Methods

This descriptive, cross-sectional study was conducted from March to September 2014. All icteric newborns (n=455), who were hospitalized at Qazvin teaching hospitals, were candidates for the study.

The inclusion criteria were as follows: 1) three- to 29-day-old icteric newborns without any pathological signs; 2) term newborns; and 3) birth weight > 2500 g. On the other hand, the exclusion criteria were as follows: 1) suspected cause of jaundice; 2) parents' unwillingness to cooperate with the study; 3) inadequate information about pregnancy or delivery (n=80); 4) other neonatal symptoms such as congenital abnormalities; and 5) premature and term newborns with a low birth weight (n=120). Finally, 255 newborns suffering from jaundice with an unknown cause were included in the study.

Data were collected using the newborns' medical records and interview sessions with the mothers. A checklist consisting of demographic, neonatal, and maternal information was used for data collection. The neonatal information included hospitalization, method of feeding, blood group, laboratory test results, and therapeutic interventions. Moreover, maternal information including pregnancy and delivery problems, mode of delivery, and anesthesia was collected.

In this study, the relationship between the severity of jaundice and predisposing factors including gender, birth weight, Rh blood group, mode of delivery, type of anesthesia, medications used during labor, and oxytocin induction was examined.

Data were analyzed by calculating descriptive statistics (mean and standard deviation) and frequency tables. T-test was used to examine the relationship between gender, mode of delivery, use of oxytocin, type of anesthesia, and bilirubin level. The relationship between the neonates' age, weight, feeding method, and blood group was examined, using Pearson's correlation test. Also, analysis of variance was used to examine the relationship between the mode of delivery and bilirubin level. P-value less than 0.05 was considered statistically significant.

This study was approved by the ethics committee of Qazvin University of Medical Sciences. Also, written consent forms were obtained from the subjects' parents.

Results

Among 255 newborns with jaundice, 53.3% (n=138) and 46.5% (n=111) of cases were male and female, respectively. The mean weight of newborns was 3097±462 g and the mean height was 48.88±2.02 cm. Based on the findings, 30.7% (n=77) of newborns were delivered by vaginal delivery and 63.9% (n=178) by cesarean section.

Spinal, general, and epidural anesthesia was used in 83.2% (n=148), 15.7% (n=28), and 1.1% of cases in the cesarean section group, respectively. Also, oxytocin was used in 87% of natural births for the induction or reinforcement of labor. Primiparous birth (n=141, 55.3%) accounted for the majority of cases. Also, 97.6% of newborns were delivered with an Apgar score of 8–10, and 72.5% of cases were breastfed.

The mean total bilirubin level in naturally delivered newborns (17.3±3.5 mg/dl) was higher than cases born by cesarean section (16.1±3.9 mg/dl); based on t-test results, the difference was statistically significant (P=0.02) (Table 1). The mean total and direct bilirubin levels among newborns delivered by oxytocin induction

Table 1. Comparison of the mean total and direct bilirubin levels between neonates born by natural delivery and cesarean section

	Total bilirubin	Direct bilirubin
Normal vaginal delivery	17.3±3.5	0.379±0.022
Cesarean section	16.1±3.9	0.397±0.013
P-value	0.028	0.111

Table 2. Comparison of the mean total and direct bilirubin levels between the groups born with and without oxytocin induction

	Total bilirubin	Direct bilirubin
Oxytocin	17.9±0.4	0.4±0.01
Without oxytocin	16.2±0.28	0.383±0.01
P-value	0.001	0.034
Spinal anesthesia	17.3±3.5	0.391±0.22
Normal vaginal delivery	15.9±0.37	0.379±0.02
P-value	0.01	0.1

(0.4±.1 and 17.99±0.4, respectively) were higher than newborns without oxytocin (0.383±0.1 and 16.2±0.28, respectively); t-test results showed a statistically significant difference (P=0.03 and P=0.001, respectively) (Table 2).

There was no significant difference between various methods of anesthesia and severity of jaundice, whereas the mean total bilirubin level in the group with spinal anesthesia (16.1±0.34) was higher than naturally delivered cases (17.3±3.5); the difference was statistically significant (P=0.01) (Table 2). Also, the mean total bilirubin level among female newborns (17.2±0.29) was significantly higher than male neonates (15.9±4.3) (P=0.005) (Table 3).

Table 3. Comparison of the mean total and direct bilirubin levels between male and female newborns

Mean values	Female	Male	P-value
Total bilirubin	3.2±17.2	4.3±15.9	0.005
Direct bilirubin	0.397±0.14	0.379±0.26	0.505

Discussion

The present findings indicated that naturally delivered neonates were more likely to have jaundice, compared to those born by cesarean section. There was a positive relationship between the severity of jaundice and mode of delivery. In fact, severe jaundice was more common among neonates born naturally, compared to those born by cesarean section.

In consistence with the present findings, Chang et al. (2011) showed that bilirubin level was higher among naturally delivered neonates, compared to cesarean cases. Overall, vacuum-assisted vaginal delivery, cephalohematoma, and oxytocin induction are considered as risk factors for hyperbilirubinemia, as suggested by Cheo and Karen nearly 25 years ago. In fact, oxytocin may directly affect bilirubin metabolism (12,13). Also, neonates born by cesarean section are more likely to receive supplements, resulting in the reduced severity of jaundice (15, 16).

Poorzanjani (2007) and Boskabadi et al. (2011) found no significant relationship between mode of delivery and jaundice (9, 14, 17). Similarly, Sharifizade et al. (2012) found no significant association between the severity of jaundice and mode of delivery. [18] On the contrary, Temoke et al. (2004) found a statistically significant correlation between the severity of jaundice and mode of delivery (11).

The conflicting results regarding the relationship between mode of delivery and hyperbilirubinemia may be due to differences between the selected variables, study conditions, and sample size, which may affect the results. In the current study, it seems that use of oxytocin during vaginal delivery may influence the positive relationship between the severity of jaundice and oxytocin use for labor induction or reinforcement.

The present findings were consistent with the results reported by Gaemi et al. (1992), Kern et al. (2005), and Chang et al. (2011) (12, 19, 20). Oxytocin with hypoosmotic effects causes water retention in red blood cells of infants and diminishes the ability of cells to change. Oxytocin also increases red blood cell lysis while passing through the vessels, thus leading to hyperbilirubinemia (21-23). Also, cortisol surge which normally occurs in the late stage of pregnancy plays an important role in fetal organ maturation.

Production of some hepatic enzymes, which excrete bilirubin in the body, depends on corticosteroids. Also, adrenocorticosteroids have a major function in preparing the liver for bilirubin excretion from the newborn's body. In fact, use of oxytocin can be associated with neonatal jaundice due to the absence of mature hepatic enzymes, caused by natural childbirth.

In this study, there was a significant relationship between jaundice and spinal anesthesia. Demiraran et al. (2011) found that spinal and epidural anesthesia was associated with a lower level of total bilirubin in neonates, compared to other types of anesthesia (24). However, Eskicioğlua et al. (2014) found no significant association between jaundice and different types of anesthesia (25).

In this study, there was a positive relationship between jaundice and neonate's gender. In fact, jaundice occurred more frequently among female newborns, compared to male neonates. Also, Boskabadi et al. (2011) found that bilirubin level was higher among male newborns, compared to the females (14). In fact, male newborns are always more susceptible to neonatal jaundice, although the cause remains unknown (23).

Conclusion

As factors such as mode of delivery, neonate's gender, and labor induction using oxytocin could influence the incidence and severity of jaundice, it seems that continuous assessment of newborns after birth could facilitate early diagnosis and patient management, affecting the subsequent complications. According to the American Academy of Pediatrics, predisposing factors should be identified and managed before neonatal

discharge. As the peak incidence of jaundice is three to five days after birth, newborns should be followed-up over this period. In addition, encouraging physiological delivery and reducing unnecessary interventions during labor could reduce the incidence and severity of neonatal jaundice.

Acknowledgements

We would like to thank all those who helped us perform this study. We also extend our gratitude to Elnazpoor for data collection.

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